AEROLOGICAL OBSERVATIONS

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Table 1 shows that the mean free-air temperatures for the month were above normal at the northern stations and below normal at the southern stations, the departures being mostly of moderate magnitude. Relative humidity departures show no unusual features. Those for vapor pressure agree, in general, with those for temperature with the exception of Broken Arrow and the upper levels at Ellendale where the relationship is inverse, i. e., negative temperature departures occurring with positive vapor pressure departures and vice versa. Resultant winds for the month were not far from normal. (See Table 2.)

A strikingly large rise in the free-air temperature from the 20th to 21st is shown by kite records made at Broken Arrow on the morning of these days and by an airplane observation made at a nearby airport on the afternoon of the 20th. Although the afternoon surface temperature rose 10° C. higher on the 21st than on the 20th, the records show that this increase began in the higher levels several hours sooner than at the surface. The morning kite record of the 20th indicates a rapid warming taking place in the upper levels at that time. At the 2,500-meter level the temperature rose 1.5° C. in less than 1 hour, 8.3° C. in 7 hours, and 19.5° C. in 26 hours. During this entire period the upper winds were from the northwest, but evidently their trajectories differed considerably. On the morning of the 20th the air at all levels observed was plainly under the influence of an extensive high-pressure area, but by the 21st the upper winds, although of the same direction as on the 20th, were blowing out of a large low-pressure area which was moving eastward across the northern part of the country. Such large temperature changes in the free air during so short a period are rarely observed.

An unusually strong wind (50 m. p. s. WNW) was observed at Sheridan, Wyo., at an altitude of 4,800 meters on the afternoon of the 5th. Pressure was very low at the time to the north of Sheridan and this depression moved rapidly eastward during the ensuing 24 hours. It is also noted that a high-pressure area prevailing to the westward was entirely displaced by a cyclonic disturbance by the next morning.

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during November, 1928*

TEMPERATURE (°C.)

Altitude m. s. l.	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)		Washington, D. C. (7 meters) [1]	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Meters												
Surface	9.3	−0.4	11.0	0.0	−0.5	+1.8	10.9	−2.3	5.4	+0.7	7.4	+0.1
250	9.2	−0.4	10.9	+0.1			10.9	−2.1	5.3	+0.8	6.5	0.0
500	7.8	−0.8	10.6	+0.6	−0.3	+2.0	10.3	−2.1	4.0	+0.9	6.2	−0.2
750	6.7	−1.1	9.9	+0.8	0.8	+2.9	9.3	−2.4	3.0	+0.8	5.6	−0.3
1,000	6.1	−1.2	8.9	+0.7	1.1	+3.0	9.1	−2.1	2.2	+0.6	4.3	−0.5
1,250	5.9	−0.9	8.0	+0.6	0.7	+2.6	8.7	−1.7	1.5	+0.5	2.7	−0.8
1,500	5.5	−0.7	7.1	+0.6	−0.4	+1.8	8.3	−1.3	0.5	+0.1	1.3	−1.4
2,000	4.2	−0.3	6.0	+1.2	−2.4	+1.4	6.7	−1.0	−1.3	+0.1	0.0	−1.9
2,500	2.0	−0.3	4.5	+1.4	−4.7	+1.3	4.0	−1.6	−2.8	+0.5	−1.6	−1.4
3,000	−0.3	−0.2	2.1	+1.2	−7.1	+1.5	2.1	−1.1	−4.7	+0.9	−4.3	−1.6
3,500	−2.3	+0.2	−0.2	+1.5	−9.6	+1.7	1.0	+0.4	−7.3	+0.3	−8.0	−2.5
4,000	−5.1	−0.1	−3.8	+0.6	−12.6	+1.6	−1.6	+0.6	−10.8	−0.5		
4,500	−8.7	−1.0	−7.8	+0.2	−15.2	+2.0			−13.0	−0.1		
5,000			−9.0	+1.3								

RELATIVE HUMIDITY (%)

Surface	69	+2	69	0	76	−2	76	+2	74	+1	65	−7
250	69	+2	67	−1			73	+1	74	+1	63	−7
500	68	+4	61	−3	73	−3	70	+3	71	−1	58	−7
750	68	+6	58	−4	62	−8	68	+5	70	0	56	−6
1,000	64	+5	57	−4	55	−10	59	0	67	0	58	−4
1,250	59	+4	55	−4	50	−11	49	−6	64	+1	62	−2
1,500	55	+3	54	−3	49	−9	45	−7	63	+4	64	+1
2,000	47	0	46	−5	45	−10	40	−6	57	+3	59	+5
2,500	44	+1	39	−4	43	−11	38	−2	60	+10	52	+3
3,000	37	−5	37	−3	40	−14	35	−1	54	+5	35	−5
3,500	31	−8	34	−4	34	−20	31	−4	54	+7	53	+13
4,000	31	−4	34	+3	33	−23	30	−3	54	+9		
4,500	31	−1	32	−3	33	−26			54	+9		

VAPOR PRESSURE (mb.)

Surface	8.51	+0.29	9.63	+0.14	4.54	+0.30	11.08	−0.95	7.13	+0.53	7.14	−0.74
250	8.47	+0.31	9.45	+0.12			10.68	−0.90	6.93	+0.41	6.50	−0.80
500	7.70	+0.30	8.42	+0.04	4.47	+0.31	9.70	−0.83	6.06	+0.22	5.94	−0.90
750	7.02	+0.23	7.71	0.00	4.06	+0.21	8.75	−0.75	5.51	+0.17	5.52	−0.81
1,000	6.38	+0.15	7.05	−0.05	3.65	+0.09	7.56	−0.95	4.93	+0.11	5.28	−0.63
1,250	5.74	+0.08	6.51	+0.14	3.21	−0.10	6.25	−1.24	4.42	+0.14	5.03	−0.51
1,500	5.19	+0.14	5.92	+0.29	2.92	−0.16	5.45	−1.12	4.05	+0.24	4.68	−0.47
2,000	4.07	+0.15	4.70	+0.43	2.33	−0.28	4.28	−0.61	3.52	+0.48	3.72	−0.31
2,500	3.40	+0.35	3.50	+0.47	1.90	−0.31	3.44	−0.36	3.54	+1.07	2.97	−0.14
3,000	2.56	+0.10	2.98	+0.65	1.46	−0.35	2.97	+0.21	2.98	+0.82	1.04	−0.79
3,500	1.95	+0.09	2.40	+0.61	0.95	−0.50	2.69	+0.58	2.71	+0.94	1.87	+0.64
4,000	1.86	+0.52	1.28	+0.39	0.60	−0.58	2.64	+1.09	2.67	+1.41		
4,500	1.76	+0.77	0.44	−0.22	0.20	−0.81			2.63	+1.65		

[1] Naval air station.

TABLE 2.—*Free-air resultant winds (m. p. s.) during November, 1928*

Altitude m. s. l.	Broken Arrow, Okla. (233 meters)				Due West, S. C. (217 meters)				Ellendale, N. Dak. (444 meters)				Groesbeck, Tex. (141 meters)				Royal Center, Ind. (225 meters)				Washington, D. C. (34 meters)			
	Mean		Normal		Mean		Normal		Mean		Normal		Mean		Normal		Mean		Normal		Mean		Normal	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
Meters	°		°		°		°		°		°		°		°		°		°		°		°	
Surface	S. 71 W.	1.4	S. 45 W.	1.6	S. 77 W.	1.0	W.	0.6	N. 61 W.	2.9	N. 50 W.	2.5	N. 80 W.	0.2	S.	0.3	S. 60 W.	3.4	S. 50 W.	2.3	S. 84 W.	1.1	N. 59 W.	1.3
250	S. 66 W.	1.5	S. 45 W.	1.6	S. 70 W.	1.1	S. 82 W.	0.7					S. 43 W.	0.4	S. 27 W.	0.9	S. 58 W.	3.4	S. 52 W.	3.1	N. 83 W.	5.1	N. 78 W.	3.7
500	S. 54 W.	2.0	S. 40 W.	2.3	S. 64 W.	2.2	S. 79 W.	1.6	N. 59 W.	3.1	N. 59 W.	2.7	S. 22 W.	1.0	S. 5 W.	2.1	S. 66 W.	6.1	S. 57 W.	5.4	N. 76 W.	7.5	N. 69 W.	5.8
750	S. 53 W.	3.0	S. 42 W.	3.2	S. 75 W.	3.0	S. 85 W.	2.4	N. 52 W.	4.7	N. 58 W.	4.1	S. 50 W.	1.0	S. 23 W.	2.8	S. 71 W.	7 8	S 62 W.	7 0	N 76 W.	8 1	N 65 W.	6 9
1,000	S 72 W.	3 2	S 54 W.	4 0	S 87 W.	3.8	S. 85 W.	3.2	N. 56 W.	5.3	N. 61 W.	5.0	S. 61 W.	1.8	S. 38 W.	3.4	S. 75 W.	8.9	S. 69 W.	7.7	N. 57 W.	9.2	N. 64 W.	7.3
1,250	S. 79 W.	3.7	S. 64 W.	4.8	N. 86 W.	4.8	S. 88 W.	4.6	N. 54 W.	5.1	N. 64 W.	5.8	S. 53 W.	2.6	S. 51 W.	4.0	S. 79 W.	9.2	S. 73 W.	7.9				
1,500	N. 88 W.	4.6	S. 74 W.	5.6	N. 77 W.	5.5	W.	5.6	N. 46 W.	6.1	N. 62 W.	6.9	S. 59 W.	3.8	S. 61 W.	4.5	W.	8.9	S. 78 W.	9.0	N. 55 W.	10.8	N. 61 W.	8.2
2,000	N. 87 W.	6.3	S. 80 W.	7.0	N. 68 W.	7.1	N. 89 W.	7.4	N. 54 W.	6.3	N. 63 W.	8.6	S. 69 W.	4.7	S. 75 W.	5.5	N. 75 W.	9.0	S. 85 W.	10.1	N. 81 W.	9.9	N. 72 W	9.8
2,500	N. 89 W.	7.0	S. 85 W.	7.8	N. 65 W.	9.3	N. 88 W.	8.9	N. 54 W.	7.4	N. 63 W.	10.8	N. 89 W.	5.7	S. 81 W.	6.9	N. 72 W.	11.6	S. 88 W.	11.9	S. 71 W.	12.5	N. 89 W.	10.7
3,000	N. 75 W.	6.0	S. 87 W.	8.6	N. 75 W.	9.7	S. 84 W.	9.8	N. 58 W.	8.2	N. 66 W.	12.8	W.	9.8	S. 84 W.	8.8	N. 74 W.	14.0	N. 85 W.	13.3	N. 89 W.	11.3	N. 81 W.	14.4
3,500	N. 75 W.	6.6	S. 88 W.	9.2	N. 87 W.	14.0	S. 81 W.	12.0	N. 74 W.	11.4	N. 68 W.	13.9	S. 76 W.	9.6	S. 75 W.	10.6	N. 74 W.	12.4	N. 84 W.	13.3	S. 77 W.	12.8	N. 82 W.	13.8
4,000	N. 46 W.	9.2	S. 88 W.	10.2	S. 61 W.	13.0	S. 79 W.	13.8	N. 59 W.	12.5	N. 68 W.	13.6	S. 22 W.	5.0	S. 72 W.	8.8	N. 74 W.	19.1	N. 87 W.	13.9	N. 68 W.	12.0	N. 75 W.	14.8
4,500	N. 54 W.	8.9	N. 80 W.	10.2	W.	12.0	S. 83 W.	14.6	N. 68 W.	14.7	N. 64 W.	16.0	S. 22 W.	4.0	S. 70 W.	10.6	N. 45 W.	16.0	N. 88 W.	13.7	N. 68 W.	14.0	N. 78 W.	18.4
5,000					W.	12.0	N. 86 W.	13.9									N. 45 W.	16.0	N. 75 W.	14.6	N. 68 W.	15.0	N. 73 W.	17.0